WOODWORK FOR SCHOOLS

ON SCIENTIFIC LINES

A COURSE FOR CLASS WORK OR PRIVATE STUDY

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PART II.

LONDON

JOHN MURRAY, ALBEMARLE STREET. W.

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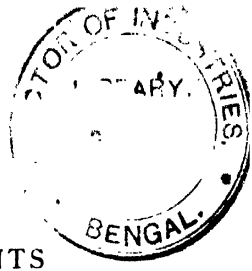

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WOODWORK FOR SCHOOLS

PART II

LESSON 21.

OXFORD FRAME.

DRAWING.—Draw the given elevation to scale of three-quarters the full size, and show a section on

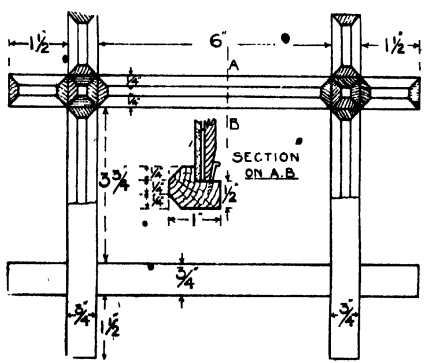


FIG. 37.—OXFORD PICTURE-FRAME.

the line AB full size. (The chamfers need only be drawn at and around one joint.) Make a perspective hand sketch to show the joint used.

Benchwork.—Material suggested: black walnut for frame, yellow pine for back, 21 oz. glass.

N.B.—In this and all future exercises you are to measure from your drawing the quantities and sizes of the materials required, and write them down in the form given for the exercises in Part I.

QUESTIONS.

1. Write notes upon walnut-trees and their products.
2. Briefly describe window-glass.

LESSON 21a.

ANGLE MIRRORS WITH DIVIDED CIRCLE, TO DETERMINE THE NUMBER OF IMAGES FORMED WHEN MIRRORS ARE INCLINED AT DIFFERENT ANGLES.

The apparatus consists of two folding grooved boards made to carry two mirrors. The mirrors can be slipped in from the top, as shown in the drawing.

The semicircular board is marked off in degrees —0° to 180°.

Drawing.—Make an elevation and plan.

Benchwork.—Make the two frames and base-board in any suitable material. Screw one frame to the base, and fasten the two frames together with a large butt hinge.

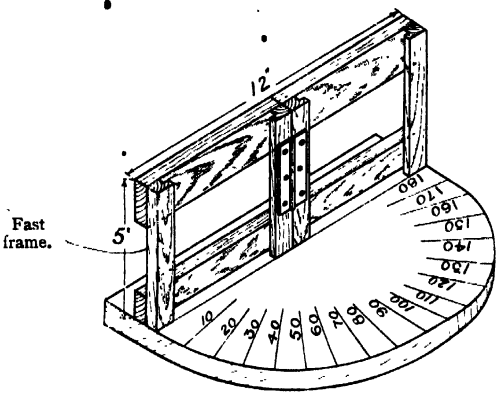


FIG. 38.

LESSON 22.

OBLIQUE SAWING AND CHISELLING.

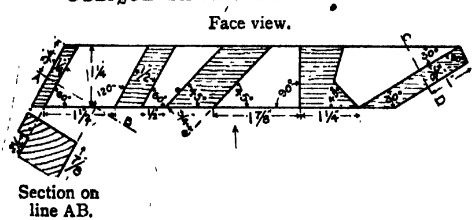


FIG. 39.—OBLIQUE SAWING AND CHISELLING.

Drawing.—A face view and a section on the line AB are shown. Draw the face view, describing the angles with the pencil compasses,

and project the edge view obtained when looking in the direction of the arrow. Also draw the true shape of the section on the line CD.

Benchwork. — Material suggested: bass-wood. Additional tool required, bevel.

QUESTIONS.

1. Make a sketch of the wing compasses, with accompanying notes on their construction and uses.
2. Write a brief description of the felling of trees, and the methods used in the conveyance of the logs.
3. State the best time for felling trees, giving the reason for your answer.

LESSON 22a.

A SIMPLE OPTICAL BENCH.

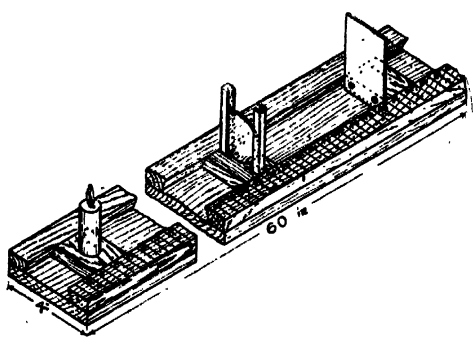


FIG. 40.

The bench is grooved to carry the movable upports for the candle, screen, and lens. The

lens carriage is made of grooved metal strips, and is so arranged that lenses of different diameters can be fitted into it. The bench is graduated, so that when a clear image is obtained on the screen, the position of the candle, lens, and screen can be accurately read off.

Prepare the necessary working drawings and execute the bench.

LESSON 23.

MATCH-BOX BRACKET.

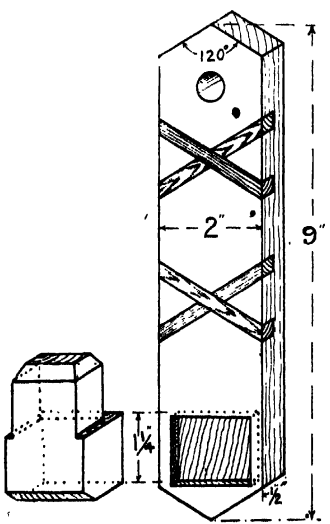


FIG. 41.—MATCH-BOX BRACKET.
View in oblique projection.

Drawing.—Oblique views are shown of the two pieces which together form the Bracket. Draw front and side elevations of the Bracket, full size, and make a hand sketch of piece A.

Benchwork.—The choice of woods is left to you; aim at securing a pleasing effect by their combination.

QUESTIONS.

1. Describe the materials used for Lesson 23.
2. Describe the different kinds of oilstones. What kind of oil would you use? Why do you prefer the particular kind you mention?

LESSON 23a.

OSCILLATING MAGNETOMETER.

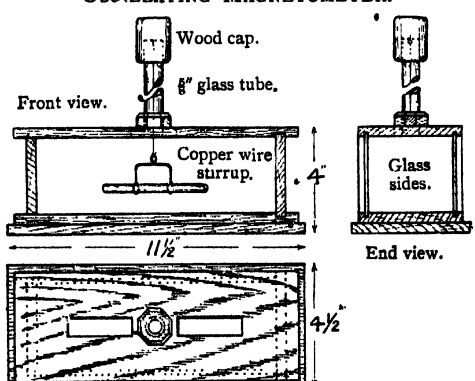


FIG. 42.

The top, bottom, and ends of the box are of wood. Rectangular pieces of glass, sliding in grooves, form the front and back, and on the bottom of the box is glued a rectangular mirror; the top of the glass tube is fitted with a cap, to which is attached a small hook, and from this is suspended a stirrup of bent copper wire, carrying the oscillating magnet whose times of oscillation are required.

Drawing.—Prepare working drawings in either orthographic or isometric projection.

Benchwork.—Make the box in some suitable material.

LESSON 24.

KEY-RACK.

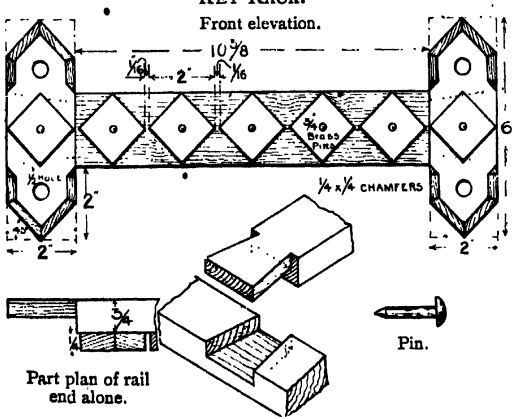


FIG. 43.—KEY-RACK.

Drawing.—Construct a scale of two-thirds. To this scale copy the front elevation of the Key-Rack and project its plan.

Make a freehand sketch of the joint used to connect the pieces together.

Benchwork.—Materials suggested: black walnut, and 1″ brass escutcheon pins for keys, button-hooks, scissors, etc., to hang upon.

Questions.

1. Sketch and describe the bevel.
2. Describe briefly the conversion of timber and its seasoning.
3. A chisel has a corner snapped off; how would you restore it to working order?

LESSON 24a.

A Test-Tube Holder.

The Test-Tube Holder is provided with a piece of elastic, which can be obtained by cutting a small

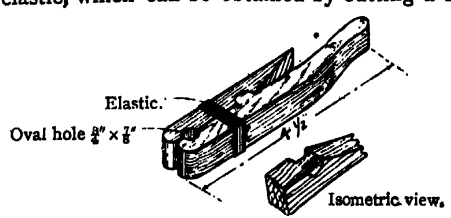


Fig. 44.

section crosswise from an ordinary piece of india-rubber tubing attached to Bunsen burner.

Drawing.—Make a dimensioned freehand sketch suitable to work from.

Benchwork.—Material suggested: white-wood.

LESSON 25.

BOOK-STAND.

Drawing.—The illustration shows a plain model of a Book-Stand in oblique projection. Prepare working drawings to a convenient scale,

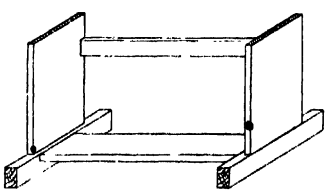


FIG. 45.—BOOK-STAND.
View in oblique projection of plain model.

showing how you intend jointing the pieces together, and completing the design in an artistic manner. You are not to exceed the following sizes:

Length	18″
Height	12″
Length of foot-pieces	9″

Benchwork.—Material suggested: mahogany.

QUESTIONS.

1. Describe some of the common faults met with in timber.

2. Keep a record of the time taken in making the Book-Stand. If you were paid at the rate of 8d. per hour, what would be the cost of labour involved in making the Stand?

LESSON 25a.

The Inclined Plane.

The plane is made of two long pieces of glass tubing, with copper wire bent round to connect them with smaller pieces of tubing, placed at the

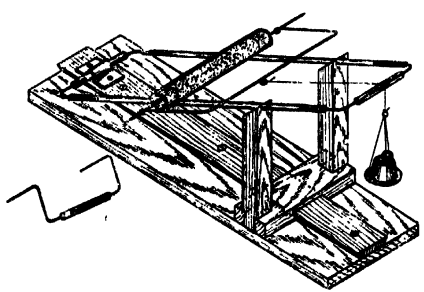


Fig. 46.

top and bottom. The roller is a piece of combustion tubing, filled with sand and corked at the ends. A knitting-needle passes through from end to end. Copper wire is bent round the needle at each end, and to the middle of this wire is attached a string, to which the scale-pan is suspended. The whole plane is fixed, as shown in the drawing, to a base-board provided with movable and

sliding supports for the variation of the angle of the plane.

The plane can be used for horizontal forces, by replacing the top piece of wire and tube with the bent piece seen detached.

Drawing.—Make the necessary working drawings.

Benchwork.—Material suggested: yellow deal, yellow pine, or white-wood, $\frac{1}{2}$" and 1" glass tubing, copper wire, copper or brass staple.

LESSON 26.

TRUING-STICK OR WINDING-LATH.

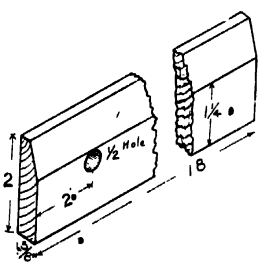


FIG. 47.—TRUING-STICK.

View in isometric projection.

Drawing.—An isometric view is shown of a Truing-Stick. Make a dimensioned hand sketch of the Stick suitable to work from.

Benchwork.—Material suggested: mahogany.

QUESTIONS.

1. Describe how you secured a perfectly straight edge on the Truing-Stick, and illustrate your description with sketches.
2. The sharpening bevel of a plane iron has worn down. State what you would do to restore it to perfect working order.
3. What is meant by warping and twisting?

LESSON 26a.

SIMPLE GALVANOSCOPE OR CURRENT INDICATOR.

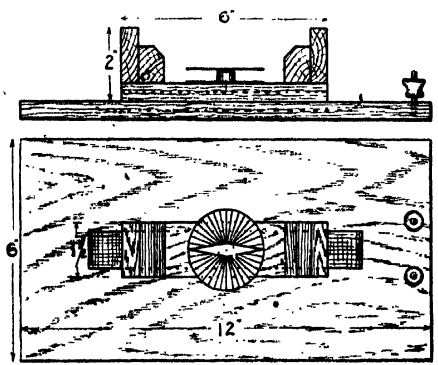


FIG. 48.—SIMPLE GALVANOSCOPE OR CURRENT INDICATOR.

This apparatus consists of a wooden framework, with sides supported by glued blocks. A groove about 1″ wide is cut underneath the bottom to

allow silk-covered wire (which is wound round the frame ten or twelve times) to lie evenly.

The frame is fastened to a wooden base, having first had a groove cut in it similar to the one in the bottom of the frame. The ends of the wires are attached to two binding screws.

A graduated paper scale is glued to the bottom, care being taken that the zero of the scale is under the middle wire.

Fix a sewing-needle vertically in a small cork so that the point projects about $\frac{1}{4}''$, and then glue the cork so that the needle forms a pivot at the centre of the card.

Place a magnetic needle about 2″ long on the pivot.

Drawing.—Make a working sketch of the model and prepare the paper scale.

Benchwork.—(See description above.) Material suggested: mahogany.

LESSON 27.

TEE-SQUARE.

Drawing.—A plan and elevation are shown of the Tee-Square. Draw a view in isometric projection, but altering the dimensions to their nearest equivalent in the Metric System.

Benchwork.—Material suggested: pear-wood or mahogany, brass screws and glue.

QUESTIONS.

1. Trace the sides of the Tee-Square, AB and

BC, measure to scale, draw a line connecting A and C, measure the line AC, and find if the square on AB plus the square on BC equal the square on AC. If so, the angle ABC is a right

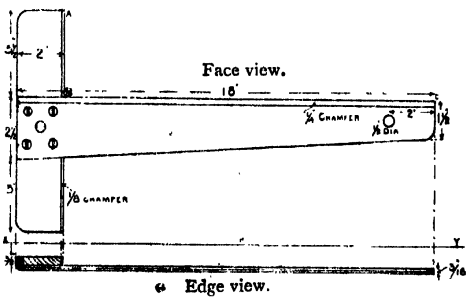


FIG. 49.—TEE-SQUARE.

angle, and your Tee-Square is exact; if not, by the aid of a protractor measure its error.

2. Describe the materials used for the Tee-Square.

3. Describe the chief points of difference between cone-bearing and leafy timber trees.

LESSON 27a.

A BURETTE STAND.

The drawing shows the chief parts necessary in the construction. An ordinary hinge is screwed at the back of the carrier to allow the burette to be fixed in position. Ordinary sash thumb-screws are used to clamp the movable piece to the

wooden support, and to keep the burette in the grooved pieces or arms. The space for the burette is lined with cork, to prevent cracking if a little extra pressure is given to the screw.

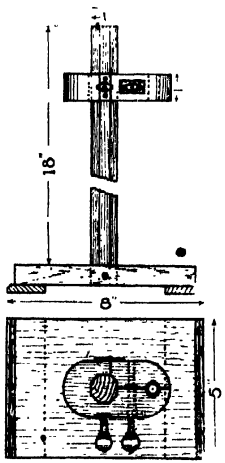


FIG. 50.—BURETTE STAND.

Drawing.—Make an elevation and plan full size.

Benchwork.—Material suggested: any moderately hard wood. The hole nearest the head of the left-hand thumb-screw must be elongated horizontally, to allow the hinged arm to move easily.

LESSON 28.

Drawing.—1. Construct a triangle having a base $4\frac{1}{2}''$ long, and the angles at the base 90° and 60° respectively.

2. The length of each of two sides of a triangle is $4\frac{1}{2}''$, and their contained angle 90°. Complete the triangle and figure the number of degrees contained in the remaining two angles.

3. Describe a circle of $\frac{1}{4}''$ radius in the centre of both triangles; draw edge views of both triangles, making them $\frac{3}{16}''$ thick, and give each a title descriptive of its use when made in wood.

Benchwork.—Material suggested: pear-wood.

QUESTIONS.

1. What are the properties of the triangles mentioned in Lesson 28?

2. Determine the areas of both triangles.

3. What is the hypotenuse of a right-angled triangle? What relation does it bear to the other two sides?

LESSON 28a.

APPARATUS TO SHOW THE LAWS OF REFLECTION OF LIGHT FROM PLANE MIRRORS.

A piece of blackened cardboard or thin wood, on which white numbers (representing angles in degrees) are painted, is bent round a semicircular base-board. In the centre of the cardboard a slit is made, to allow rays of light to enter from a candle or lamp placed at the back. A small

to" mirror, C, is fixed to the movable wooden indicator, B.

Drawing.—Prepare elevation and plan, and where a turning lathe is provided, prepare a full-size design of one leg.

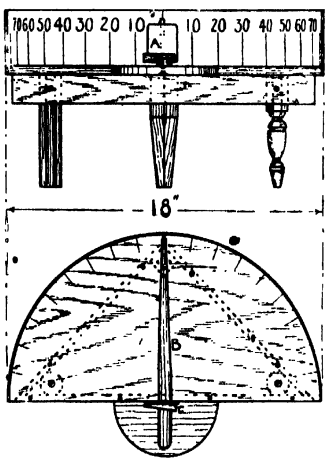


FIG. 51.

Benchwork.—Make the base-board and triangular framing in white-wood. If wood is used for index-board, it should be of ash or other pliable timber, and should be steamed before being bent.

Make the legs out of beech, and, if no lathe is available, make them octagonal or square and tapered in section.

LESSON 29.

SOAP-TRAY.

Drawing.—Determine the dimensions of a block of soap, and prepare working drawings of a Soap-Dish to hold it, using Metric measurements. The dish is to have an open front, and the bottom is to be grooved with a gouge and sloped towards the back, to prevent any accumulation of water.

Benchwork.—Material suggested: sycamore and brass screws.

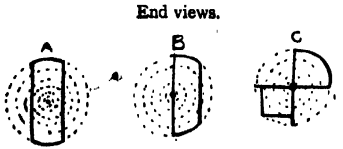


FIG. 52.—SHRINKAGE OF TIMBER

QUESTIONS.

1. Describe sycamore and maple trees and their products, calling attention to any differences between the two trees of which you are aware.

2. Say what you know of the different kinds of gouges with which you are acquainted.

3. Three tree-trunks are suggested in section by the dotted lines in the sketches A, B and C (Fig. 52). The heavy lines indicate the shape of some timber cut from the trees. Show by sketches the effect of shrinkage on these pieces, and give reasons to account for the change of shape which would take place in each case.

LESSON 29a.

BOX TO CARRY LEYDEN JAR BATTERY OF FOUR.

The bottom of the box is lined with tinfoil, and a thin strip is placed up the side to touch the inner points of the metal handle, which is screwed

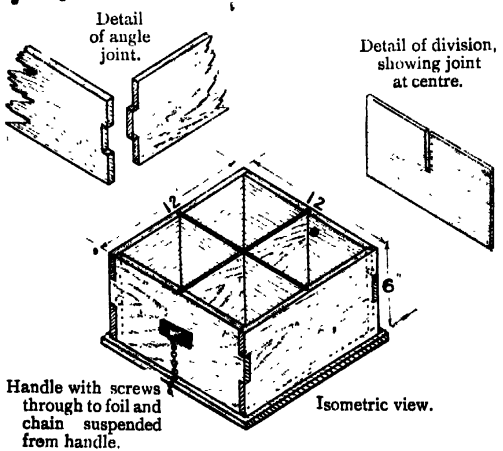


FIG. 53.—BOX FOR LEYDEN JARS.

on from the outside. A chain is fixed to the handle of such a length as to allow it to touch the bench when the box is placed in position.

Drawing.—Prepare elevations and plan to scale of half full size, and make freehand sketches of the joints to be used.

Benchwork.—Make the box in any suitable

material, gluing the joints together and securing the bottom on to the sides with screws.

LESSON 29b.

COLLAR-BOX.

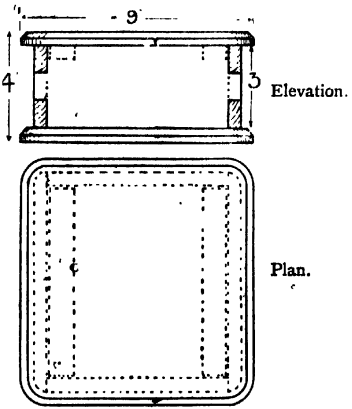


FIG. 54.—COLLAR-BOX, HANDKERCHIEF-BOX, TIE-BOX.

Top may be carved, or designs may be applied in Brushwork, in Gesso, or Repoussé.
For details of angle joints, see Lesson 29a.

Boxes for other purposes—to contain ties, handkerchiefs, jewels, etc.—may be substituted for the collar-box.

The lid and sides of the box offer opportunities for the application of decorative design by means of Brushwork, Gesso, Repoussé, or Carving.

Drawing.—Make an isometric drawing of the box you have chosen to make. Show freehand

sketches of the corner joints. The lid is not hinged, but is kept in place by two ledges nailed or screwed to it.

Benchwork.—The kind of material to be used should be that which is best adapted to whatever decorative treatment is decided upon.

White-wood and bass-wood are suitable for Brushwork and Gesso; white-wood, oak, kauri, walnut, etc., for Carving.

LESSON 30.

NET-PEG.

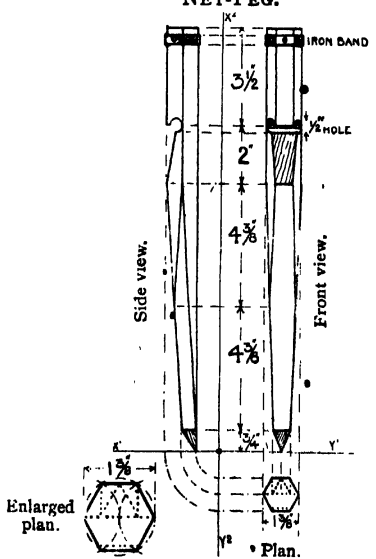


FIG. 55.—NET-PEG.

Drawing.—Draw the plan first, then project the two elevations from it. Scale, half size.

Benchwork.—Material suggested: beech, strip-iron, and flat-headed nails.

The ½" hole should be bored before working the hexagonal prism.

QUESTIONS.

1. Say what you know of the beech.
2. What is the object of the iron band on the net-peg? Make a drawing in your notebook to determine the length of the band of iron required to go round the top of the peg.

LESSON 30a.

LEYDEN JARS FOR PREVIOUS BATTERY-BOX.

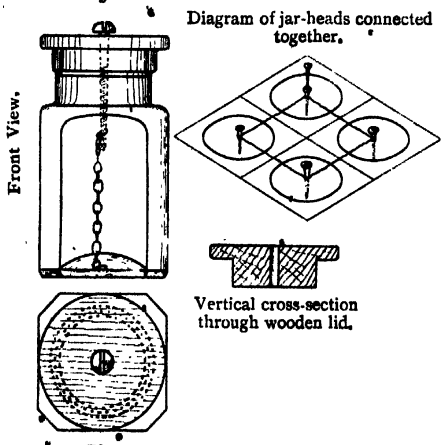


FIG. 56.—LEYDEN JARS FOR PREVIOUS BATTERY-BOX.

Drawing.—Make freehand sketches to illustrate what is required for this lesson.

Benchwork.—Take four ordinary glass pickle-jars; line the sides and bottom inside and out with tinfoil. The sides are lined to within 2″ of the top of the jar.

Make a wooden circular top to fit each jar. Through this screw a long screw with large head, and attach a metal chain to the lower end, of such a length that it touches the bottom of the jar.

Place the jars in position in the box, and connect the screws by means of copper wire.

LESSON 31.

DESK RULER.

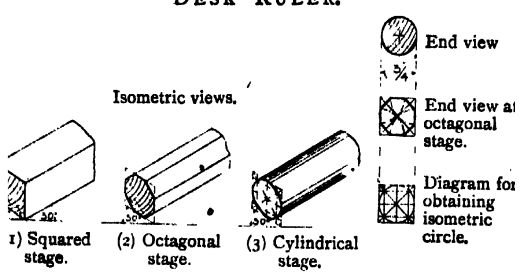


FIG. 57.—DESK RULER.

Drawing.—Draw the end elevation shown, and project from it a side elevation 14″ long. The three isometric views show the three stages of manufacture. Copy these three views full size.

Benchwork. — Material suggested: American black walnut.

QUESTIONS.

1. Determine the area of the end of the ruler.
2. Find the volume of the ruler.
3. Prepare a piece of paper to cover the curved surface of the cylinder without overlapping. What geometrical figure does the paper now represent? Find its area, and from your observations give a formula which represents the area of the curved surface of the cylinder.

LESSON 31a.

A PIPETTE STAND.

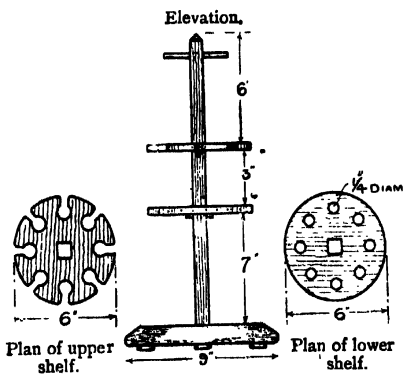


FIG. 58.—A PIPETTE STAND.

Drawing.—Draw the three views shown, and project a complete plan from the elevation.

Benchwork.—Material suggested: stem and base of white wood, shelves of mahogany.

The stem to be mortised, and fox-wedged into base.

The shelves are supported by cylindrical pegs.

LESSON 31b.

MALLET.

Drawing.—Prepare a plan, an elevation, and a section to explain the joint of the mallet.

Benchwork.—Material suggested: beech or ash.

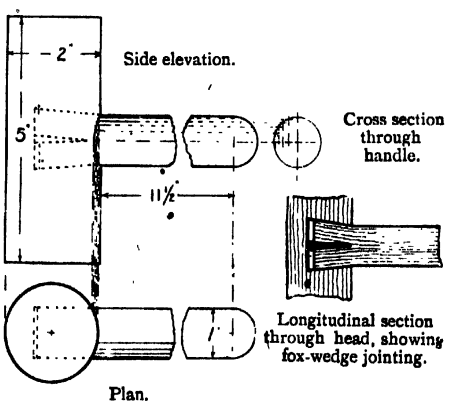


FIG. 59.—MALLET.

LESSON 32.

LETTER E.

Drawing.—Make full detailed working drawings, full size, in any form of projection you choose other than that shown.

Benchwork.—Before commencing your work,

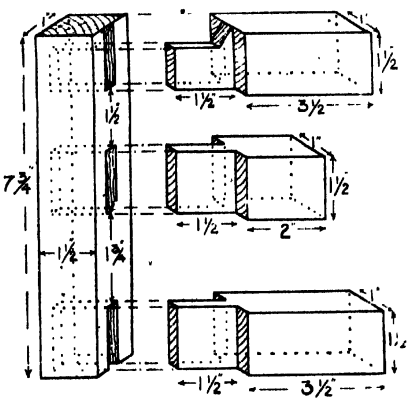


FIG. 60.—LETTER E.

Mortising and tenoning exercise. View in oblique projection of joints apart.

weigh the piece of wood, and make a note of its weight in your notebook.

Material suggested: yellow pine.

QUESTIONS.

1. Give the names of any parts of the Manual Training-Room where you have noticed any of the joints of Lesson 32 used.

2. Make sketches of Rip, Hand, Tenon, and Bow saws, showing distinctly the form of the teeth of each.

3. Describe the Mortise gauge.

4. Weigh the wood after working the model. How much has been lost in working?

LESSON 32a.

MAGNETOMETER.

An instrument for comparing the relative intensities of magnetic poles.

It consists of a shallow box, the two graduated arms forming part of the bottom. Two of the

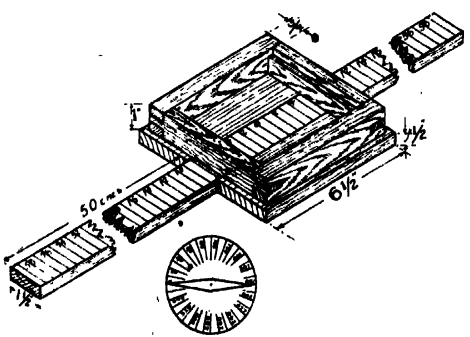


FIG. 61.—MAGNETOMETER.
Isometric view.

sides of the box have their top edges rebated to receive a piece of glass.

The magnet is placed on the graduated arms

which point east and west. The magnetic needle is fixed on a fine-pointed needle, and moves round the paper scale marked in degrees. The magnetic needle should be so suspended that it moves with as little friction as possible.

Drawing.—Prepare working drawings of the magnetometer, introducing the most suitable joint of the three in Lesson 32.

Benchwork.—Execute the model in what you consider suitable material.

LESSON 33.

TRY-SQUARE.

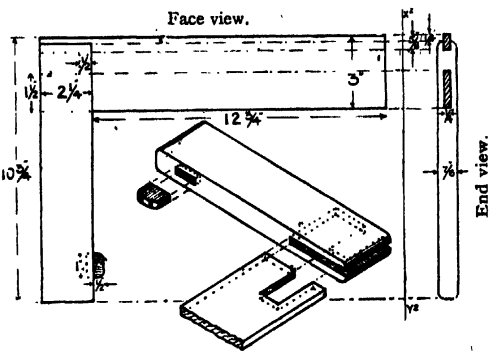


FIG. 62.—WOOD-SQUARE.

Drawing.—Make a rough dimensioned sketch from an actual try-square, and from your sketch

only, and without reference to the square itself prepare all the necessary working drawings.

Benchwork.—Material suggested: mahogany.

QUESTIONS.

1. Describe briefly the sharpening of saws.

2. Show by sketches how you would test the accuracy of a try-square, and apply those tests to the model you have made.

LESSON 33a.

A STAND TO ILLUSTRATE THE PARALLELOGRAM OF FORCES.

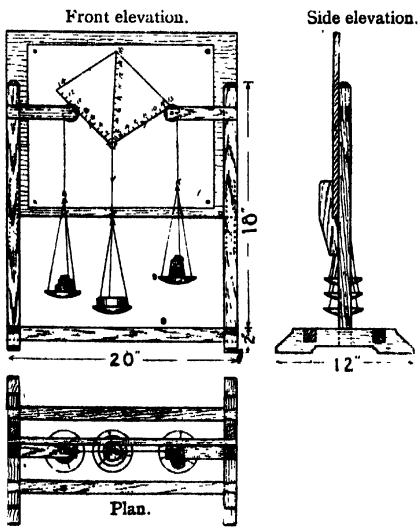


FIG. 63.

The arms of the wooden stand are fitted with small pulleys, round which string passes. Attached to the string are small pans or pill-boxes to carry the different weights used as the forces. Behind the stand a drawing-board is fixed, to which a sheet of drawing-paper is fastened. The drawing-board is fixed by means of cleats, which allow the board to be easily removed. Part of the diagram can be traced out on the drawing-paper when the board is in position, and the parallelogram afterwards completed to scale. The resultant is obtained by measuring the length of the diagonal, each unit of length representing the unit of weight decided upon when commencing the experiment.

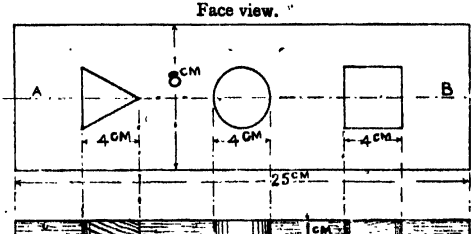
Drawing.—Prepare the necessary working drawings of the stand with sketches of the joints.

Benchwork.—Make the stand in some suitable material.

LESSON 34.

WOOD PUZZLE.

Face view.



Section on line AB.

FIG. 64.—WOOD PUZZLE.

Drawing.—A face view and section on AB are shown. Draw a view in isometric projection, full size. Make a freehand sketch of a block of wood which will fit each of the three holes.

Benchwork.—Material suggested: oak.

The circular hole to be worked with a centre-bit and scribing gouge.

QUESTIONS.

1. Give a brief description of oak.
2. How would you convert a log of oak into boards so as to show the medullary rays to their best advantage?

LESSON 34a.

MODEL OF THE CAPSTAN.

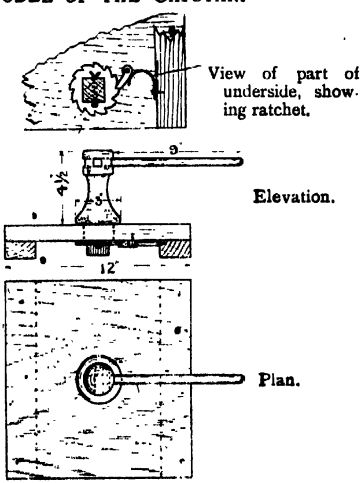


FIG. 65.—CAPSTAN.

This model can be used to illustrate in a modified form the principle of the wheel and axle.

In the capstan the axle is represented by the barrel, and the effort is applied at one or more points in a horizontal direction by means of the handspike.

Drawing. — Make working sketches of the model and a carefully-drawn detail of the ratchet mechanism.

Benchwork.—Where a lathe is available, the barrel may be turned. The ratchet wheel and catch may be shaped from pieces of brass.

LESSON 35.

FOOTSTOOL.

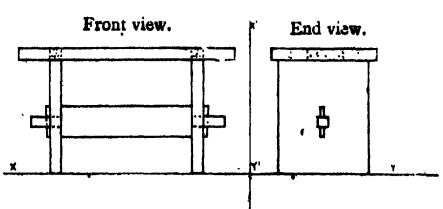


FIG. 66.—FOOTSTOOL.

Drawing.—Construct a scale of one-third.

To this scale draw three orthographic views of a footstool, involving the same principles of construction as that shown in the two given views of a plain stool. You may adopt any design and any

dimensions you consider suitable. Make freehand sketches of the joints used.

Benchwork.—Material suggested: white-wood.

QUESTIONS.

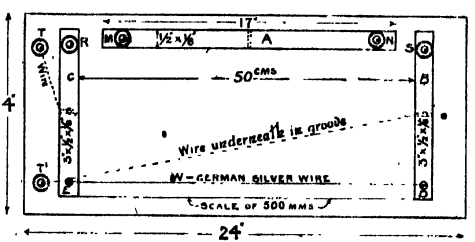
1. What points of difference are there between the trees and timbers of the white-wood and bass-wood?

2. If $\frac{7}{8}$" white-wood is sold at $4\frac{1}{2}$d. per foot super, what will be the cost of the timber for twenty footstools?

3. Suppose you are paid at the rate of $8\frac{1}{2}$d. per hour for your labour, give the cost of the footstool in time and material (the latter to be determined in accordance with Question 2).

LESSON 35a.

A WHEATSTONE BRIDGE.



Plan.

FIG. 67.—A WHEATSTONE BRIDGE.

This consists of a deal board, 2′ × 4″ × ½″, planed smooth both sides. Three pieces of copper or brass, one 17″ × ½″ × ⅛″, and the remaining two

3″ × ½″ × ⅛″. File off rough edges and polish. Solder a rather thick copper wire to the middle of each piece underneath, as shown, one 24″ long and the other 30″ long, and a short one from top left hand binding-screw to brass plate of 8″ long. Each piece of brass should be filed across the middle, so that the wire, when soldered, lies flush with the surface. Drill holes near the ends of the brass pieces large enough to carry a binding-screw. Also drill smaller holes at D and E. Place the pieces on the board so that the inner edges of B and C are exactly 50 centimetres apart, and mark the position of the holes by pushing a bradawl through; then mark a place on the board at the points where the wires spring from the pieces. Remove the brass pieces, and bore holes through the board at the marked places.

Now solder a piece of German silver wire to the ends of the left and right brass pieces, so that it is exactly 50 centimetres long between them. Pass the end of the wire attached to A through the hole in the board at that point; pull the wire, and then fasten the brass in place by means of the binding-screws M and N. Similarly, after passing the wires from the middle of B and C through the holes, fasten one end of each piece by the binding-screws at R and S. Now place the other ends of B and C so that the wire W is rather tight, and then fasten them in position by the screws D and E.

Make two holes through the board at T and T′, and then, turning the board over, make a groove

from B to T' for the wire to lie in, and another from C to T. Stretch the wires (shown by dotted lines), and place their ends in the holes, so that they are in metallic contact with the two binding-screws fixed at T and T'. Place a scale, divided into 500 millimetres, from end of wire W.

LESSON 35.

MARKING-GAUGE.

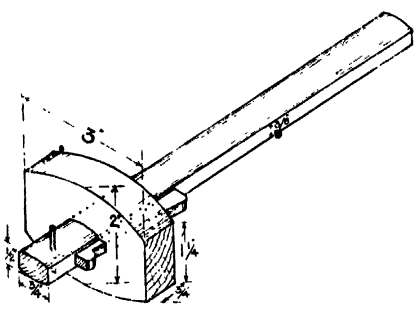


FIG. 68.—MARKING-GAUGE.
Isometric view.

Drawing.—An isometric view of the Gauge is given. Draw three orthographic views, full size, and give sketches of the spur and wedge.

Benchwork.—Material suggested: beech.

QUESTIONS.

1. What are the products of the Beech-tree commonly used for?

Why are a Jack-Plane and a Smoothing-Plane each fitted with two irons?

LESSON 36a.

A FILTER-STAND TO CARRY TWO FUNNELS.

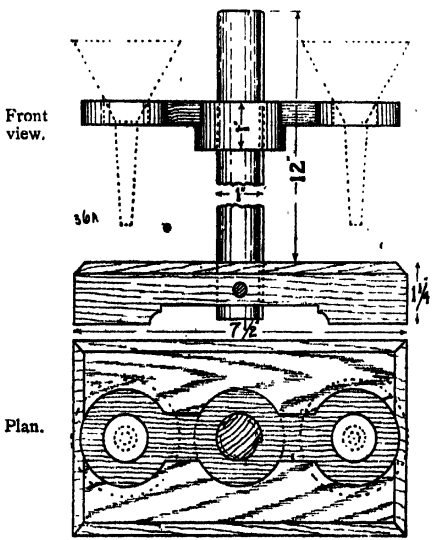


FIG. 69.—FILTER STAND.

Drawing.—Prepare full-size working drawings.

Benchwork.—A cross section of the stem shows a cam-like shape; the support for the funnels is

fitted to this cam in such a manner that a slight horizontal turn looses it, allowing the support to be adjusted to any height. The base and stem are glued and pinned together.

LESSON 37.

DRAINING-STAND.

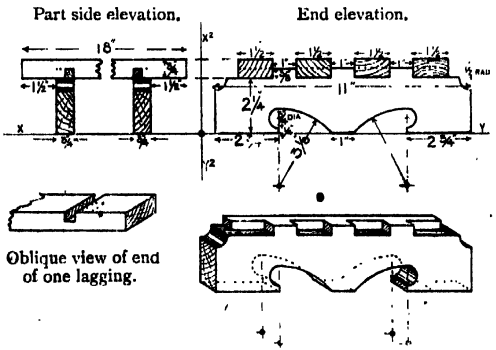


FIG. 70.—DRAINING-STAND.

Drawing.—Draw the two elevations as shown, and in place of the given oblique views of the details draw them in isometric projection.

Benchwork.—Material suggested: elm for feet, white deal for laggings.

QUESTIONS.

1. Describe the tree and wood of the Elm, stating any special peculiarity it possesses. For what reason is it chosen for the draining-board?

2. Make a parcel of the draining-stand, and state what it would cost to send it to Chicago, U.S.A.

LESSON 37a.

DIFFERENTIAL AIR THERMOMETER.

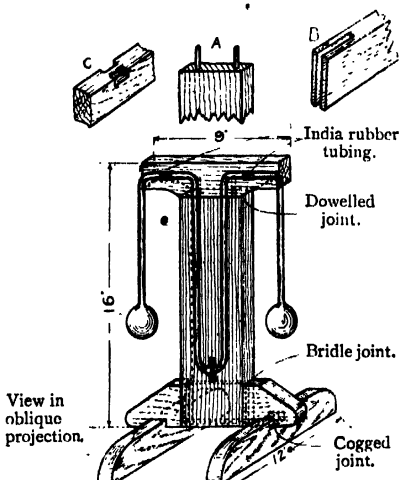


FIG. 71.—DIFFERENTIAL AIR THERMOMETER.

This consists of the wooden stand, provided with glass tubing, bent as shown. The end pieces are blown into bulbs and fitted to the bent U-tube by means of india-rubber tubing. A paper scale is pasted on the stand in such a way that the move-

ments of the liquid, placed in the bend of the U-tube, can be read easily.

Drawing.—A view in oblique projection is shown.

Draw two elevations and a plan. Make hand sketches of the joints.

Benchwork.—The top and upright pieces are dowelled together, as shown by detail A; the lower end of the upright piece is bridled into lower rail (see detail B), and the rail is cogged to the edges of the foot-piece (see detail C).

LESSON 38.

INKSTAND.

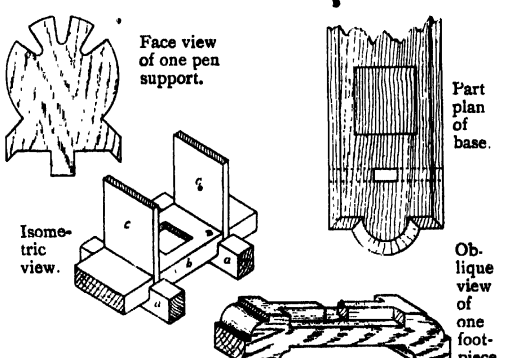


FIG. 72.—INKSTAND.

Drawing.—A plain model of the Inkstand is shown in isometric projection, and enlarged details are shown of the parts.

Draw two elevations and a plan, adopting what you consider to be suitable sizes.

Benchwork.—Material suggested: mahogany or walnut.

QUESTIONS.

1. In what way is wood valuable commercially other than as timber?

2. If Mahogany is sold at 8s. 6d. per cubic foot, what is the value of the timber needed for twenty inkstands like the one you have made?

LESSON 38a.

AN ELECTRIC BOX

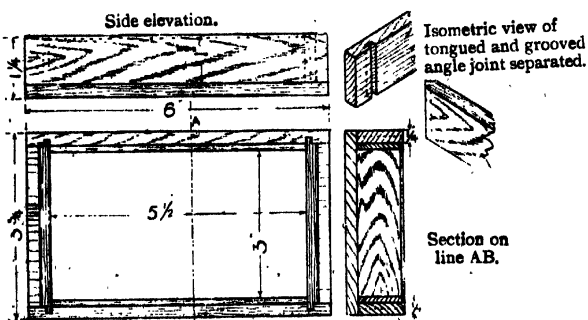


FIG. 73.—ELECTRIC BOX.

Drawing.—Make an isometric view of the box, and a freehand sketch of tongued and grooved joint. This model is intended to illustrate three

principles in Statical Electricity: (*a*) The generation of electricity by friction; (*b*) the attraction of non-electrified bodies by a charged body; (*c*) the repulsion of bodies charged with like electricity.

(*a*) The glass cover on being rubbed with silk, woollen leather, or fur, becomes charged with electricity.

(*b*) Pith balls, grains of charcoal, bits of paper, or other light bodies inside the box, are drawn up to the glass cover.

(*c*) The light bodies, as soon as they become charged as in (*b*), suddenly shoot off the glass, and discharge their electricity on the tinfoil.

Benchwork.—The sides and ends are tongued and cross-grooved jointed, glued, and nailed together; two pieces to support the glass are glued to the sides, and the bottom nailed on to the sides and ends.

Before nailing, the parts should be sand-papered and the tinfoil glued to the bottom, the glue being spread on the bottom rather than on the tinfoil.

LESSON 39.

FIRE-SCREEN.

Drawing.—Two elevations of a fire-screen and enlarged details of the joints are given. Prepare the necessary working drawings, making any alterations in the ornamental parts of the design you think desirable.

Benchwork.—Material suggested: oak or mahogany.

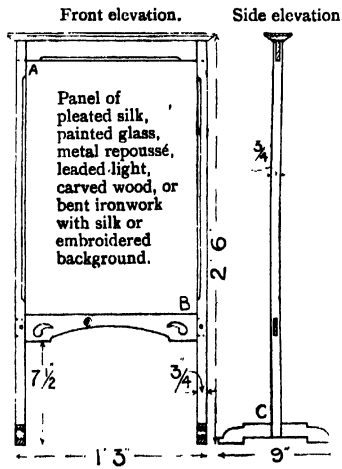


FIG. 74.—FIRE-SCREEN.

QUESTIONS.

1. Make a freehand sketch of a vertical section of a Jack-Plane, in exact working order, the section to be taken in the centre from nose to heel (City and Guilds, 1901).

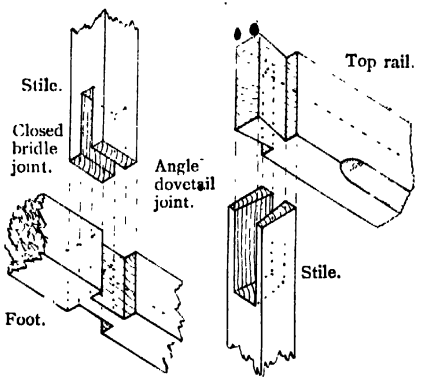


FIG. 75.—FIRE-SCREEN.
Details of joints at A and C.

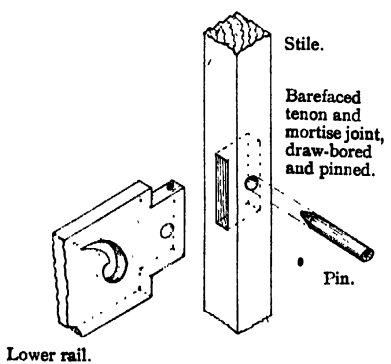


FIG. 76.—FIRE-SCREEN.
Detail of joint at B.

LESSON 39a.

APPARATUS TO PROVE BOYLE'S LAW FOR PRESSURES GREATER OR LESS THAN ONE ATMOSPHERE.

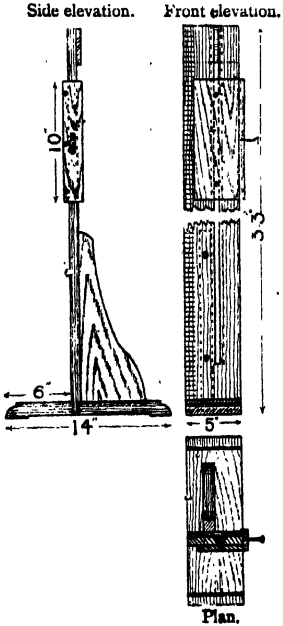


FIG. 77.—BOYLE'S LAW APPARATUS.

Drawing.—Prepare what you consider to be the necessary working drawings.

Benchwork.—The glass tubes are burettes, to which india-rubber tubing is attached, and made fast by copper wire wound round the parts of the burettes which fit in the tubing. The tube on the right is moved up and down by means of the wooden carriage to which it is fixed, and the height of the mercury in each tube is readily ascertained by noting the levels on the divided scale.

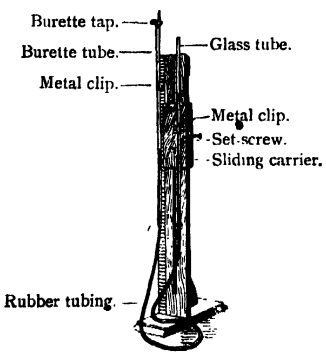


FIG. 78.

The base and upright are dovetail tongued and grooved together; the upright is supported by a bracket piece, to which it is screwed.

The drawings show the construction of the carriage, part of which slides in the dovetail groove of the upright.

LESSON 40.

Model of Original Design.

Drawings.—Prepare drawings of a model of your own design, together with a list of materials required.

Benchwork.—When your drawings are approved, work your model in the material you have suggested.

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